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Geophysical Surveys at the 1100-EM-1 South Pit

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Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

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Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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Internal Memo

From: T. H. Mitchell and J. R. Kunk
Phone: 6-1747 G6-50
Date: February 4, 1991
Subject: TECHNICAL MEMORANDUM DOCUMENTING GEOPHYSICAL SURVEYS AT THE 1100-EM-1 SOUTH PIT.

To: S. W. Clark H4-55

cc: J.W. Fassett G6-50
D.G. Horton H4-56
K.M. Singleton H4-56

SCOPE

This technical memorandum summarizes the results of the geophysical surveys conducted at the 1100-EM-1 Operable Unit, South Pit Sub-operable Unit. These surveys were conducted by the geosciences group, Westinghouse Hanford Company as outlined in the Remedial Investigation Phase II Supplement Work Plan, Draft A, Section 4.8.13. The geophysical methods used included ground penetrating radar (GPR) and electromagnetic induction (EMI). The surface of the site was also mapped.

PURPOSE

The purpose of the geophysical surveys were to determine the depth of fill, the boundary of burial areas, and the location of buried objects at the South Pit. The information gathered will be used in conjunction with all data collected during the site characterization investigations to determine responsibility for this site.

LOCATION

The South Pit is adjacent to the Horn Rapids Landfill along the south side of the landfill, separated only by the Horn Rapids Road, (Figure 1). Figure 2 shows the specific site layout with geophysical grid points surveyed on 15 meter centers. The surveys were initiated on November 6, 1990 and field work were completed on November 27, 1990.

PROCEDURES

The geophysical surveys were conducted following the procedures contained in the Environmental Investigations and Site Characterization Manual, (WHC-CM-7-7); in particular, Section EII 11.2 , Geophysical Survey Work, Rev 1.

The GPR surveys were conducted with an SIR System 8 manufactured by Geophysical Survey Systems, Inc. and a 300 MHz antenna. An EM31 non-contacting terrain conductivity meter manufactured by Geonics Limited was used for the EMI work.

RESULTS

Surface mapping:

Surface features observed by walking over the site are shown in Figure 3. The South Pit has clearly been the site of dumping. Items such as tin cans are delineated on the figure as dense surface metal. Other non-native materials observed on the surface include rock piles with cobbles on the order of several to tens of centimeters in diameter, fibrous shingles, and apparent ash and clinkers possibly from coal fired plants.

EMI surveys:

Figure 4 shows the EMI data in profile form and Figure 5 shows the same data in contour form. The data was collected in line with the grid points, with additional readings at approximate 5 meter intervals between the 15 meter grid points. Along the edge of these figures are the grid line numbers and letters for location. The nominal conductivity for the South Pit area is roughly in the range of 5 to 7 millimhos/meter. The general trend depicts an increasing apparent conductivity in the near surface materials to the west. Topographically, this also is the lowest part of the South Pit area.

The anomalous area, where conductivities vary greatly, is on the north side of the South Pit and extends to and possibly under the Horn Rapids road. The anomalous area, as depicted by EMI methods, is delineated either by the profile or contoured data by departure from generally flat profiles (Figure 4) or by tight, complex contour lines, (Figure 5).

GPR surveys:

Figure 6 shows the anomalies from the GPR data. GPR traverses were run both east-west and north-south along the 15 meter survey grid. Additionally, closer traverses were run in the vicinity of grid point G-6 to try to enhance any data from below the near surface. Data enhancement through filtering and signal averaging did not significantly improve the results or bring out radar reflections from deeper in the section.

The GPR data generally delineates the same anomalous zone on the north side of the South Pit as the EMI data. Unfortunately, the conductivity of the surface materials in this anomalous area are high enough, either from the scattered metal, or from the material in the apparent coal burning waste, that the GPR penetration below the near surface was not possible.

Aerial photography:

Three sets of aerial photographs were examined for this site after the geophysical surveys and preliminary interpretations were complete. They do not offer sufficient resolution or detail to enhance the geophysical results, but do help support some of the observations.

The aerial photos were taken on May 24, 1948, November 2, 1964, and on April 24, 1973. The 1948 photo, copied in part in Figure 7, shows the South Pit and Horn Rapids Landfill at a time of obvious subsurface and surface disturbance. The approximate

burial boundary from geophysics correlates well with the disposal pit and debris on the original 1948 photo. Unfortunately, the amount and type of debris cannot be determined from the photo. Linears we have called "Dozer" tracks in Figure 3 are evident on the aerial photos and are useful for location and scaling. A disturbed area, as seen on the 1948 photo in the southeast corner of the South Pit study area, has been interpreted by others to be a knoll, suggested here as possibly the spoils from digging the disposal pit area of the South Pit. Presently, the interpreted knoll does not exist nor does a significant depression occur at the disposal pit site. The South Pit area has generally been leveled since the 1948 photo and before a 1964 photo, where the ground appears generally level, covered by vegetation. The 1973 photo shows no particular change from the 1964 photo. The reader is referred to the original photographs and overlays for more detail.

Conclusions:

The radar system scans a zone below the antenna and extending sideways to about 45 degrees to each side. Therefore, information about the subsurface is obtained from more than just directly below the 15 meter wide survey tracts. But 100% subsurface coverage of the area was not obtained due to the separation of the survey lines. Additionally, in the northern side of the area, depicted by the wiggly lines on Figure 6, penetration much below the surface was not obtained. With these caveats in mind, no anomalies which would reasonably be interpreted to be buried barrels were observed.

Radar anomalies, scattered primarily over the northern and eastern portion of the south pit area are generally due to isolated pieces of metal, such as tin cans and cables, at and within one foot of the surface. Figure 8 shows the approximate boundary of the interpreted burial area.

A possible analog area to the South Pit is the dump site adjacent to the 618-13 area in the 300-FF-5 Operable Unit. This dump site is a depression on the order of 3 meters deep. This pit has been backfilled with a variety of wastes, including loads of asphalt, rocks, and ash from a coal burning plant. This technical memorandum in no way implies that this "analog site" is what the South Pit once looked like, but surface apearances and the types of materials present at the surface have many similarities between the two sites and offer an interesting comparison.

RECORDS

Logbook WHC-N-306-5 contains information for these surveys.

Submitted by:

J.R. Kunk
T.H. Mitchell

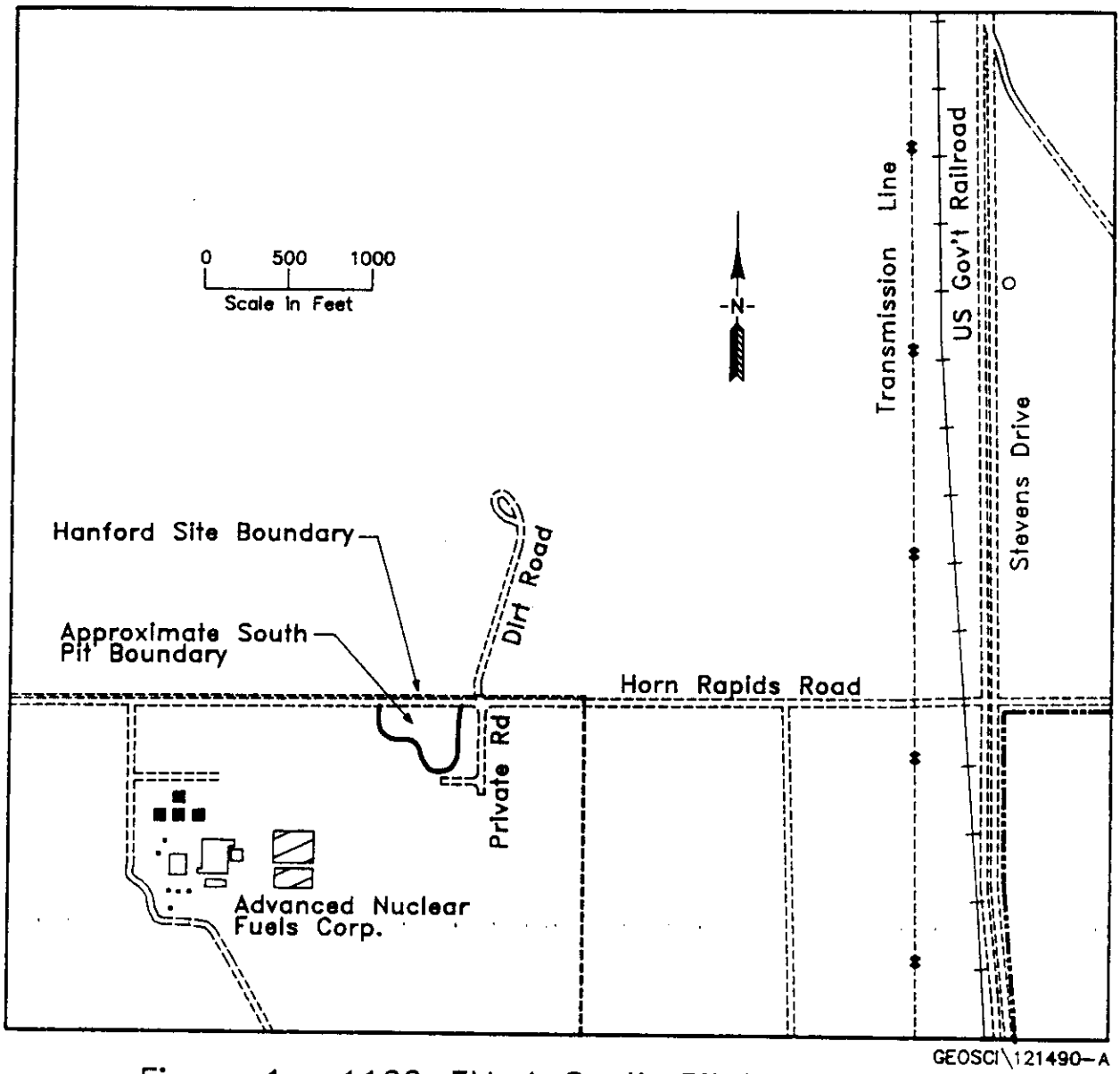

Figure 1. 1100-EM-1 South Pit Location Map

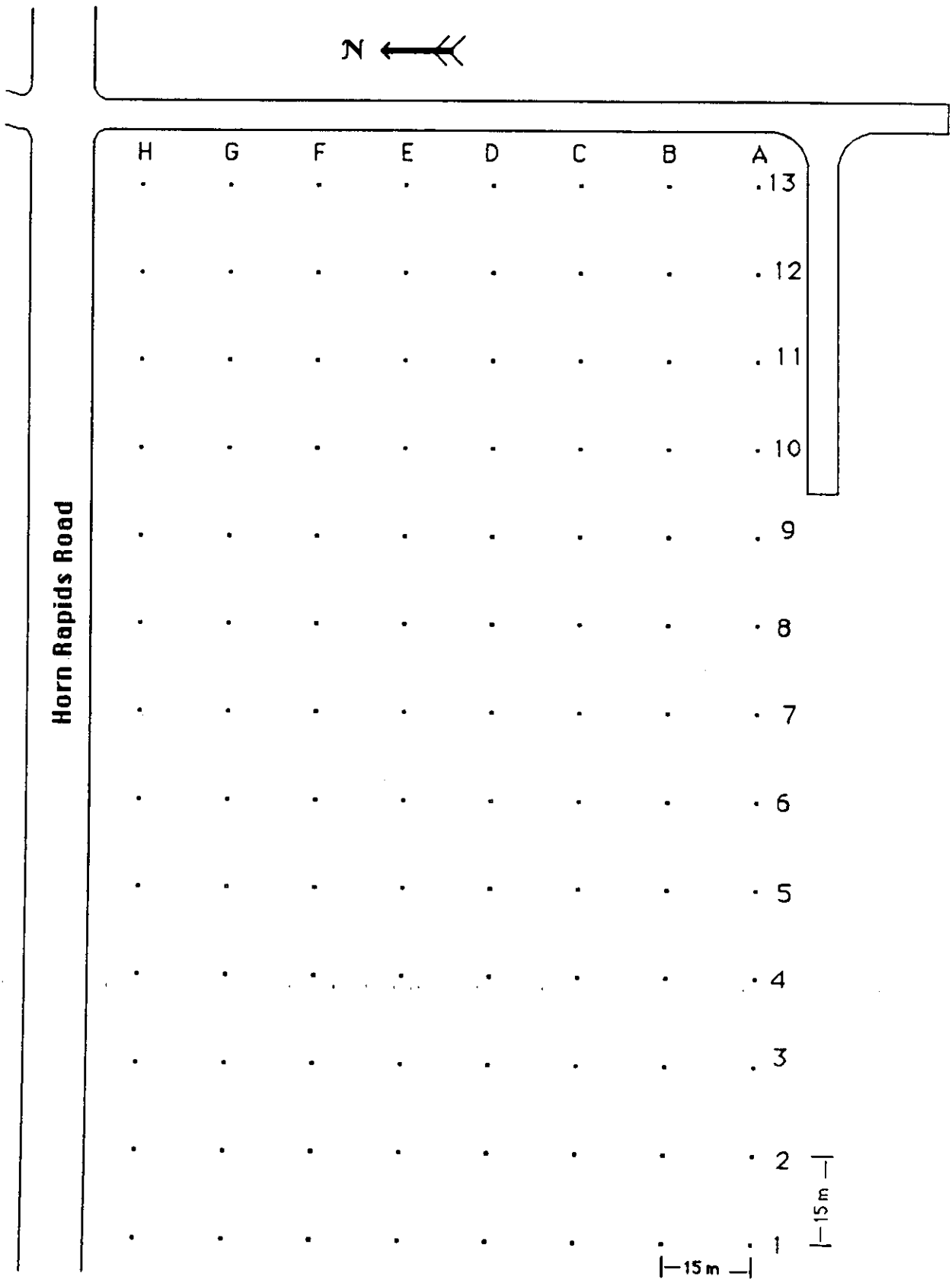

Figure 2. 1100-EM-1 South Pit Survey Grid

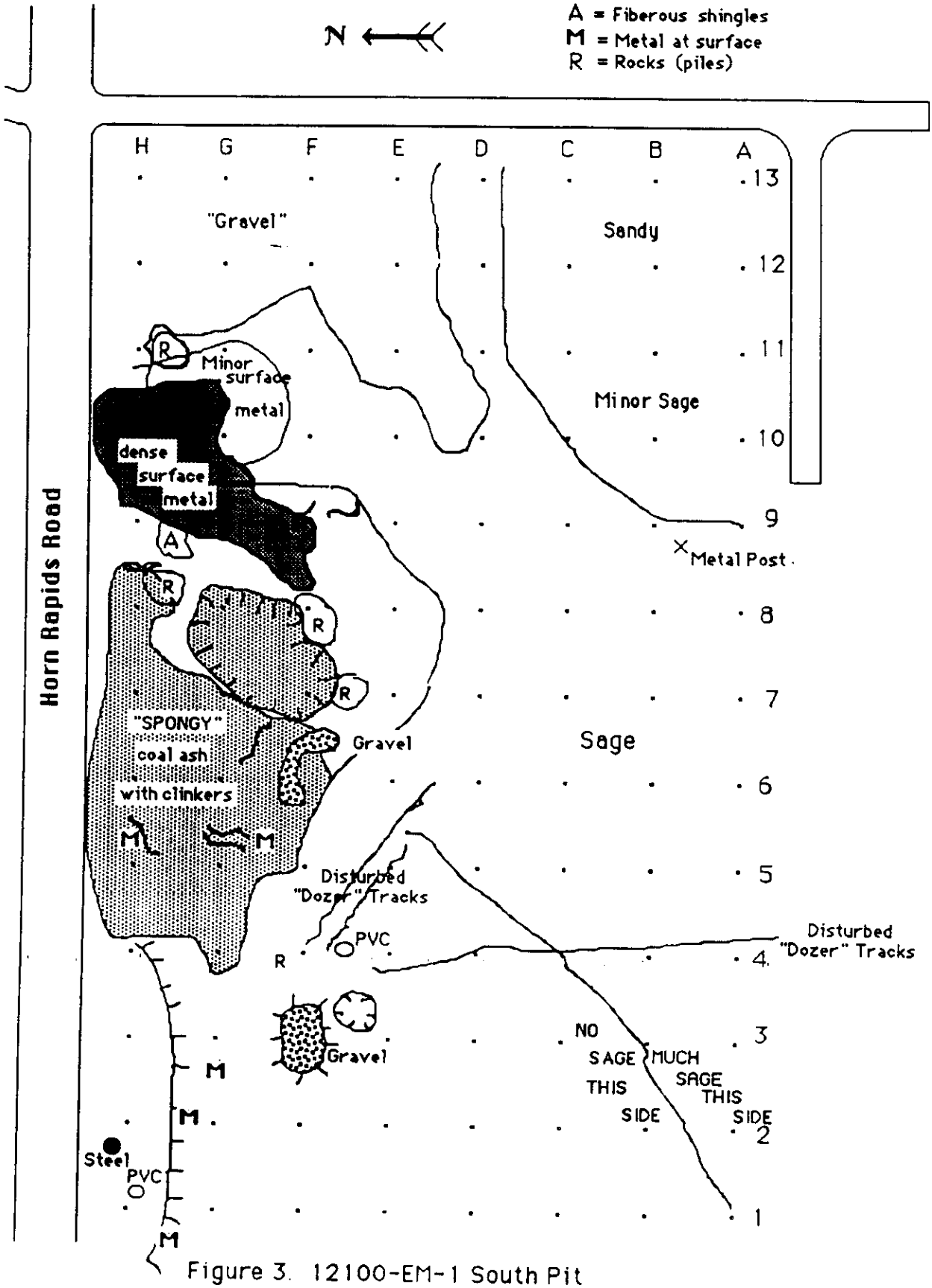

Figure 3. 12100-EM-1 South Pit
Surface Features

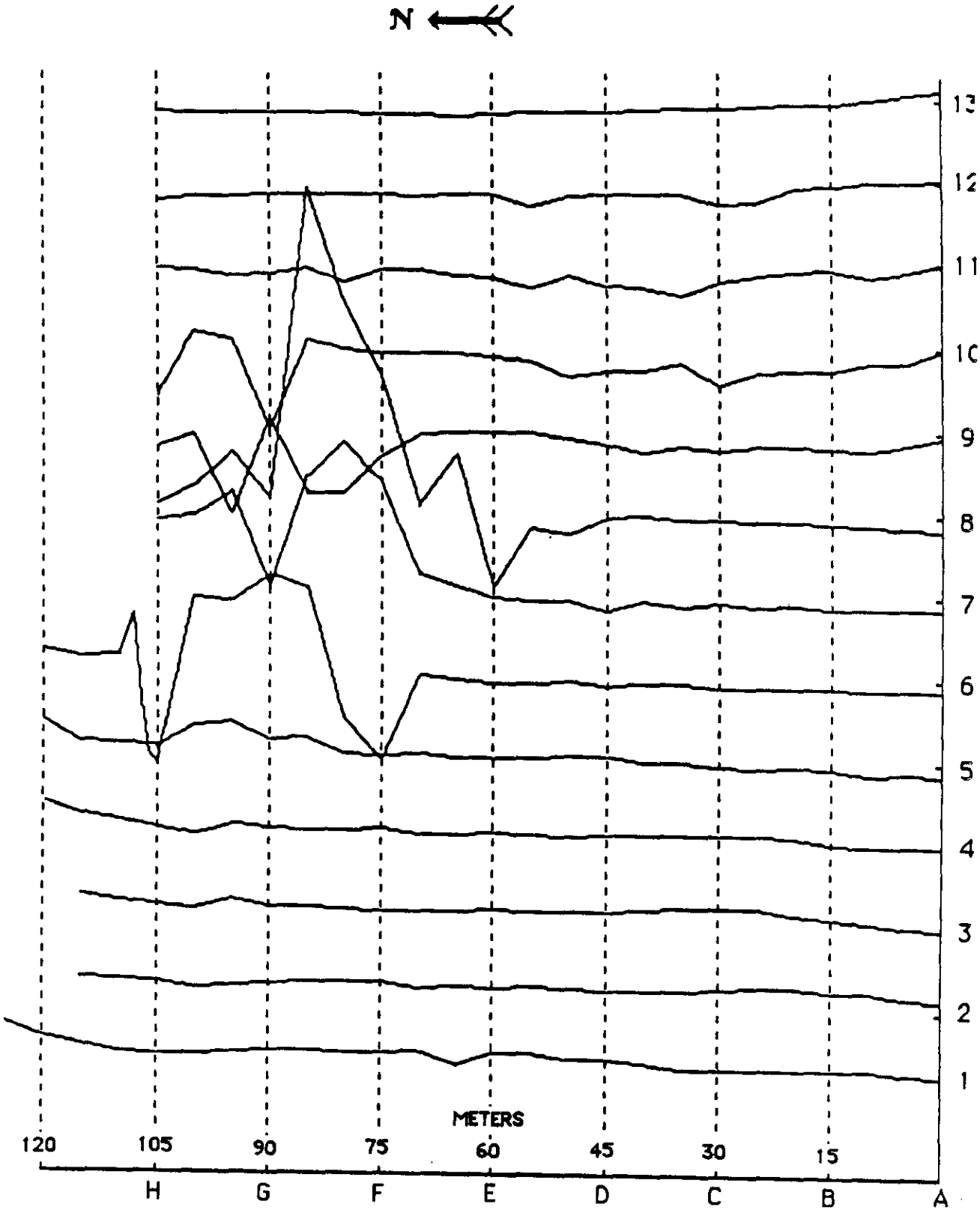

Figure 4. 1100-EM-1 South Pit.
EM1 Profiles

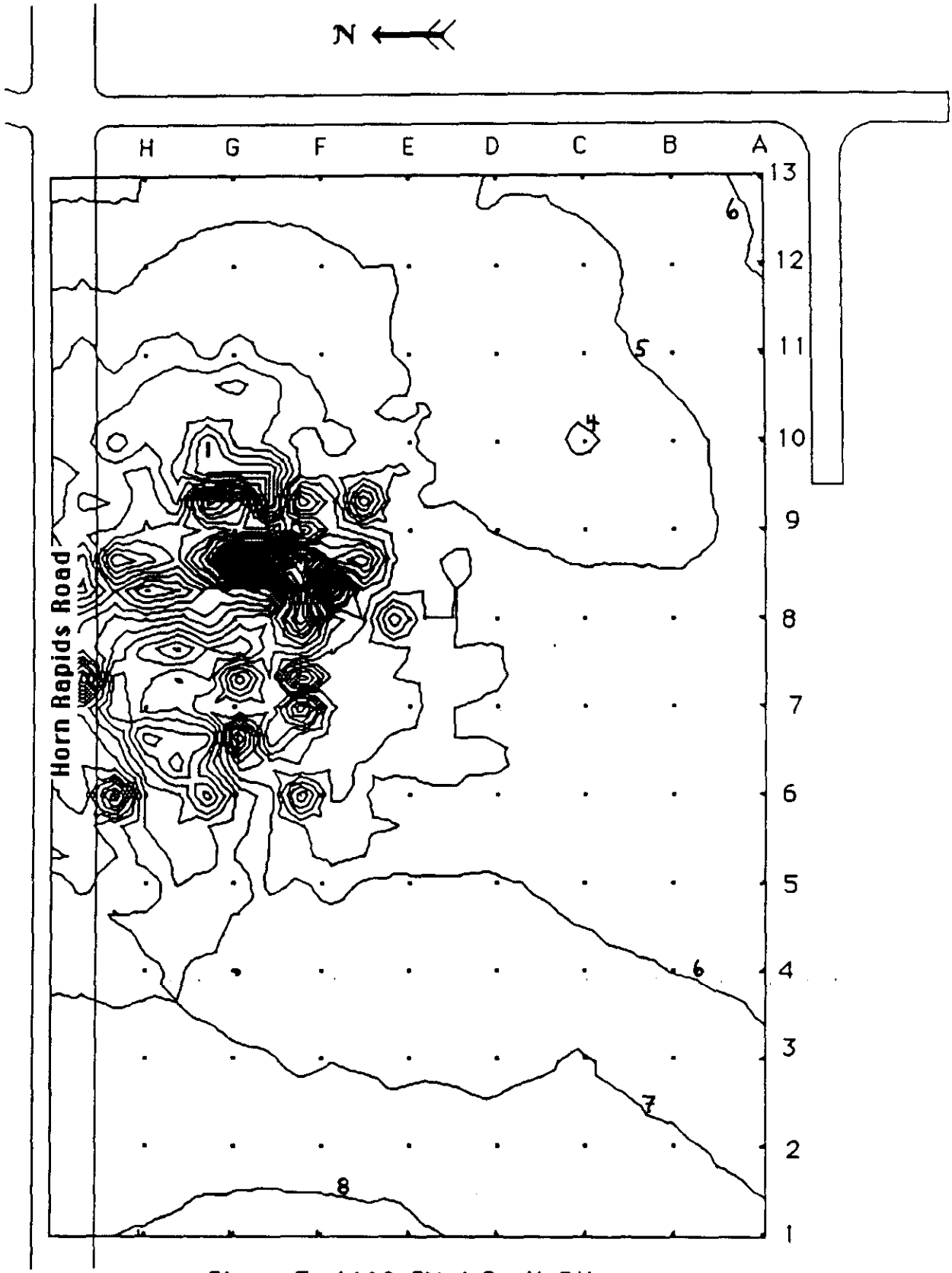

Figure 5. 1100-EM-1 South Pit
EMI Contour Map (1 millimho/meter
contour interval)

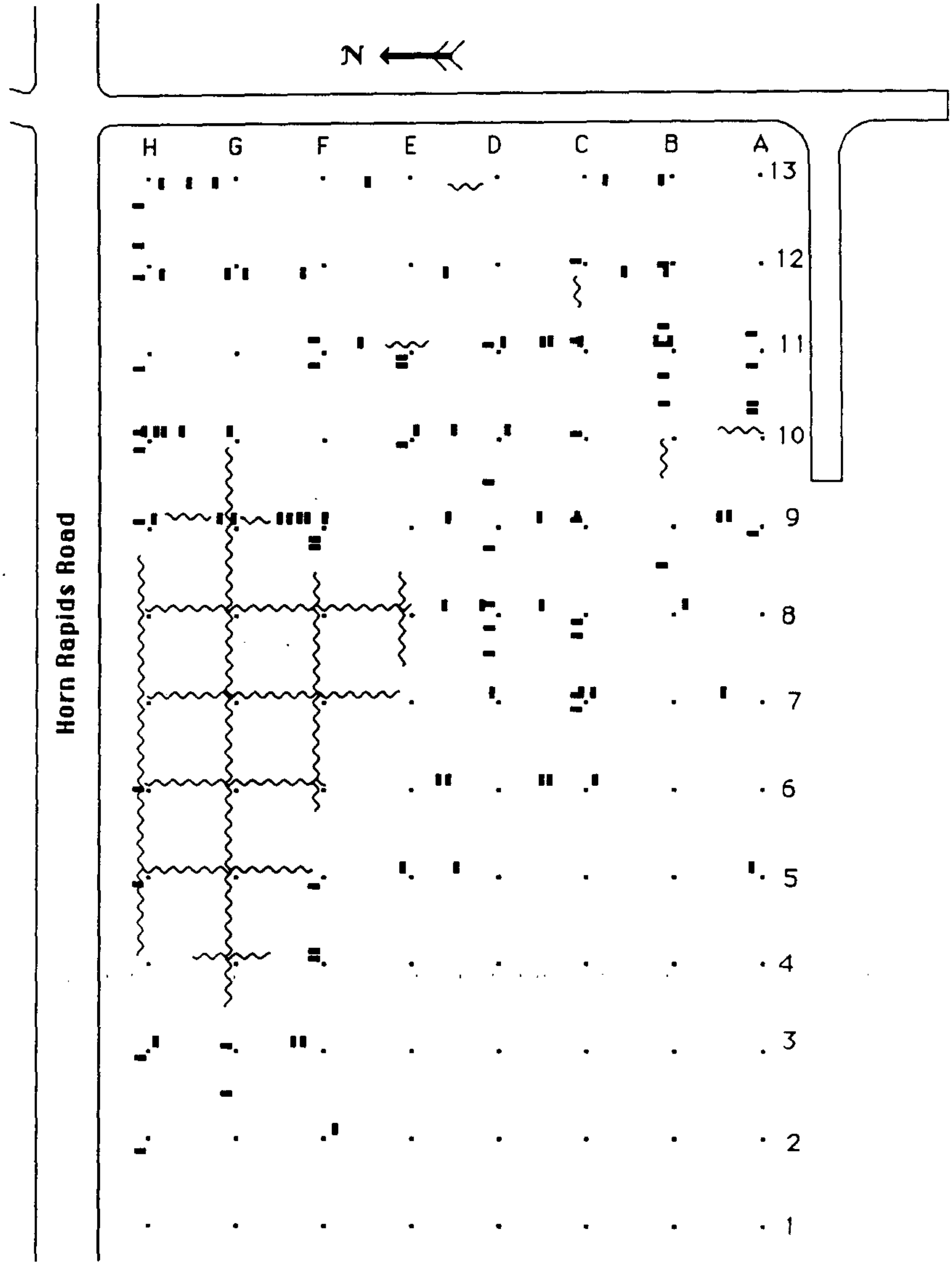

Figure 6. 1100-EM-1 South Pit
Radar Anomalies Map

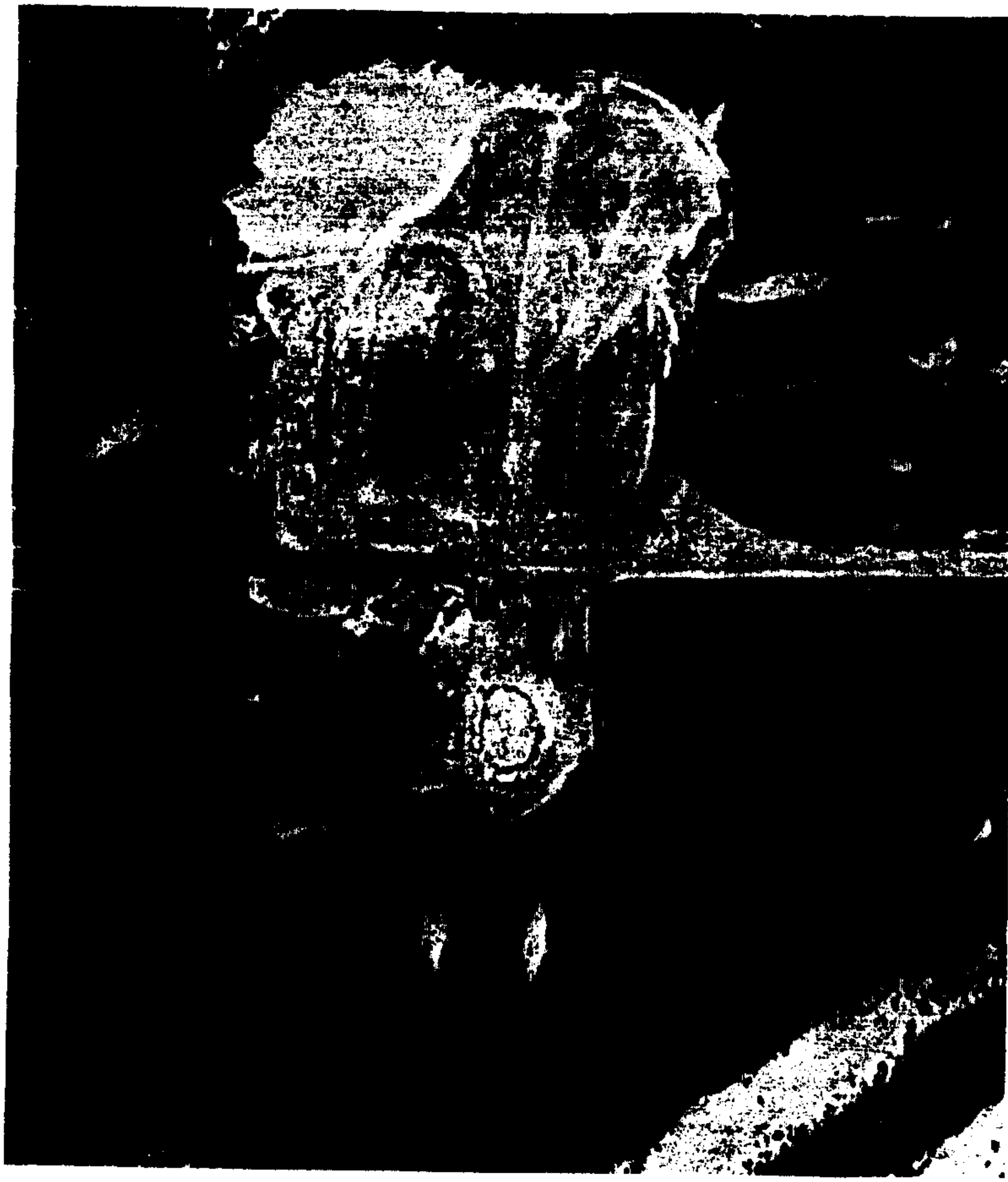

Figure 7. Aerial photograph of the Horn Rapids Landfill / South Pit area, flown May 24, 1948. Approximate scale: 1 inch = 320 feet.

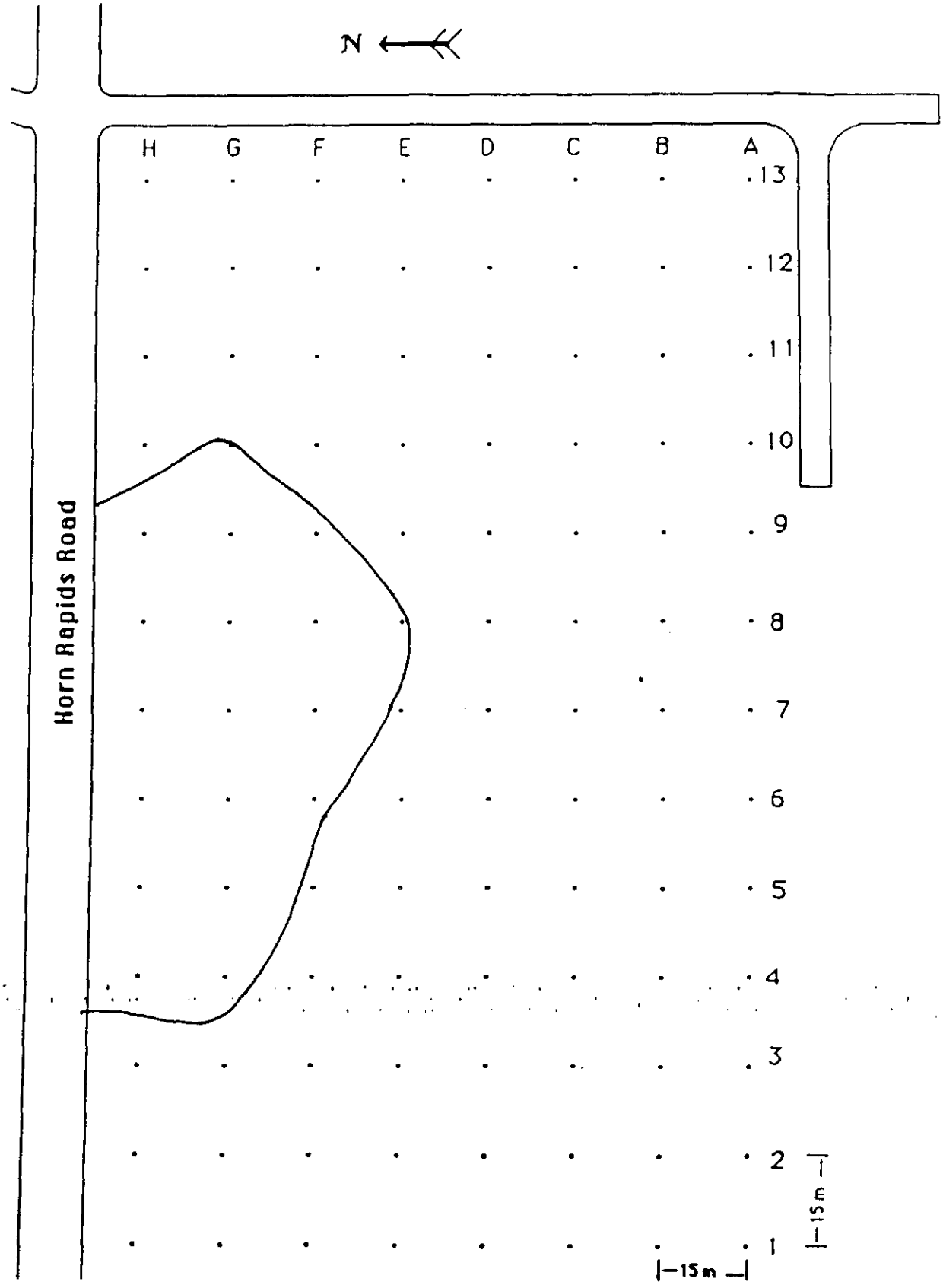

Figure 8. 1100-EM-1 South Pit.
Approximate burial boundary.